

# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 2000-357016 (71)Applicant : MITSUBISHI HEAVY IND LTD

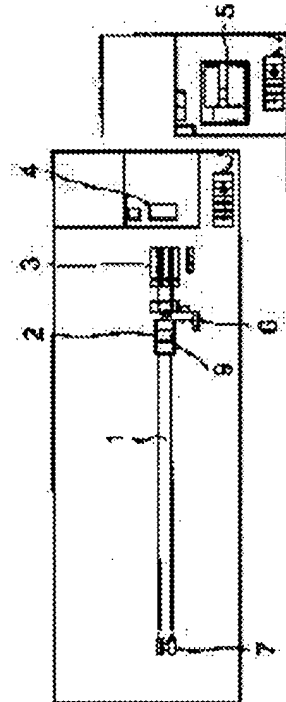
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## (54) SERVO ACTUATOR DEVICE IN VEHICLE CRASH SIMULATOR

### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a servo actuator device in a vehicle crash simulator improving accuracy of simulation wave forms by adopting a meter out method that controls the amount of working fluid flowing out from a hydraulic actuator 10.

SOLUTION: The servo actuator device in the vehicle crash simulator pushes out a piston rod 15 of the hydraulic actuator 10 toward a cart 2 mounting a body 9 to be tested using the working fluid 14 stored and pressurized in an accumulator 12. The accumulator 12 is connected so that the working fluid directly flows into the hydraulic actuator 10, and a servo valve 11 is connected so as to compose a meter out circuit that controls the working fluid flowing out from the hydraulic actuator 10.



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## CLAIMS

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### [Claim(s)]

[Claim 1] Servo-actuator equipment in the automobile collision simulator characterized by to connect said accumulator so that it may be servo-actuator equipment in the automobile collision simulator which hammers out a specimen towards the cart to carry and hydraulic oil may flow the piston rod of an actuator into said actuator directly with the hydraulic oil accumulated with the accumulator, to connect said servo valve so that the hydraulic oil which flows out of an actuator may be controlled, and to constitute the meter-out circuit.

[Claim 2] Said accumulator is attached in this cylinder and parallel at the posterior part of the cylinder of said actuator. Said accumulator and said cylinder are directly linked through passage, and the duct which supplies hydraulic oil is connected with said accumulator from a pump unit in this passage. Said servo valve is servo-actuator equipment in the automobile collision simulator according to claim 1 characterized by being attached in this cylinder and parallel at the anterior part periphery of said cylinder, and connecting this servo valve and said cylinder through passage.

[Claim 3] Said piston rod is servo-actuator equipment in the automobile collision simulator according to claim 1 or 2 characterized by having been prepared before and after the piston and having projected outside from said cylinder order.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the servo-actuator equipment in the automobile collision simulator which used the meter out control system.

[0002]

[Description of the Prior Art] The servo-actuator equipment used for drawing 3 by the conventional automobile collision simulator is shown. The outline configuration of this servo-actuator equipment 3 is carried out with the actuator 10, the servo valve 11, and the accumulator 12. An actuator 10 consists of the piston 14 and piston rod 15 which were formed in a cylinder 13 and this cylinder 13. The piston rod 15 was projected from the anterior part of a cylinder 13, and the tip has countered the back end side of said cart 2.

[0003] The servo valve 11 consists of spools 31 prepared in the oil sac 30 formed in the posterior part of the cylinder 13 of an actuator 10. The passage 32 containing hydraulic oil and the passage 33 which discharges hydraulic oil to an oil tank are connected [ oil sac / 30 ].

[0004] An accumulator 12 consists of a body 22 of an accumulator of the cylinder mold attached in the back end section of a cylinder 13, and a piston 23 prepared in this body 22 of an accumulator. \*\* of hydraulic oil 24 and a posterior part is filled up with gas 25, such as nitrogen, at \*\* of the anterior part (actuator 10 side) of a piston 23. Hydraulic oil 24 flows from said passage 32 to a servo valve 11, and the piping 35 which supplies a pressure oil from a pump unit leads to passage 32.

[0005] The hydraulic oil 24 accumulated with the accumulator 12 flows into an actuator 10 through passage 36, a piston rod 15 is hammered out, and a cart 2 and a specimen 9 are made to generate acceleration equivalent to a real vehicle collision, when a servo valve 1 opens.

[0006]

[Problem(s) to be Solved by the Invention] Since the servo-actuator equipment in the above-mentioned conventional automobile collision simulator is a meter-in system which controls the amount of the hydraulic oil which flows into an actuator 10 by the servo valve 11, the oil pressure force in the actuator 10 before printing initiation is equal to atmospheric pressure. This meter-in system did not have the leakage of the hydraulic oil from a piston rod 15, and since it started printing in the condition that the rigidity of the hydraulic oil in an actuator is low while it had the advantage that the capacity of the pump at the time of pressure accumulation of an accumulator 12 was small, and ended, its initial responsibility of a piston was bad and it had the technical problem that simulation wave precision was bad.

[0007] This invention aims at offering the servo-actuator equipment in the automobile collision simulator which raised simulation wave precision by adopting the meter out control system which controls the amount of the hydraulic oil which flows out of an actuator in view of the technical problem of this conventional technique.

[0008]

[Means for Solving the Problem] This invention is characterized by connecting said accumulator so that it may be servo-actuator equipment in the automobile collision simulator which hammers out a specimen towards the cart to carry and hydraulic oil may flow the piston rod of an actuator into said actuator directly with the hydraulic oil accumulated with the accumulator, in order to solve this technical problem, connecting said servo valve so that the hydraulic oil which flows out of an actuator may be controlled, and constituting the meter-out circuit.

[0009] According to this invention, the hydraulic oil in an actuator flows out, a piston rod is hammered out by the pressure of the hydraulic oil of an accumulator, it hits against a cart, and a cart and a specimen are made to generate acceleration equivalent to a real vehicle collision by supplying hydraulic oil to an accumulator,

accumulating pressure to it, where a servo valve is closed, and opening a servo valve in this condition. Thus, since the hydraulic oil in an actuator serves as high pressure equal to the pressure of an accumulator at the time of printing initiation of a piston rod since it is considered as the meter out control system which controls the hydraulic oil by the side of the outflow by the servo valve, and the rigidity of hydraulic oil becomes high, printing responsibility can improve and the whole simulation precision can be raised greatly.

[0010] Moreover, said accumulator is attached in this cylinder and parallel for this invention at the posterior part of the cylinder of said actuator. Said accumulator and said cylinder are directly linked through passage, and the duct which supplies hydraulic oil is connected with said accumulator from a pump unit in this passage. Said servo valve is attached in this cylinder and parallel at the anterior part periphery of said cylinder, and it is characterized by connecting this servo valve and said cylinder through passage.

[0011] Since the accumulator and the actuator are directly linked through passage, while according to this invention the hydraulic oil of an accumulator carries out a direct action to the piston of an actuator and powerful and high printing of precision of it becomes possible, since the servo valve is attached in the anterior part periphery of a cylinder, it can constitute the meter out which is an outflow side and controls hydraulic oil.

[0012] Moreover, this invention is characterized by having formed said piston rod before and after the piston, and having projected it outside from said cylinder order. Since the piston rod formed before and after the piston has projected from cylinder order according to this invention, it becomes possible to make good actuation of balance perform at a piston.

[0013]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail using the example shown in the drawing. However, the dimension of the component part indicated by this example, a configuration, its relative configuration, etc. are not the meaning that limits the range of this invention only to it but only the mere examples of explanation, as long as there is no specific publication especially. In addition, in each drawing, the same sign shows the same member as drawing 3, or the thing of the same function.

[0014] Drawing 1 is the outline block diagram of a hydraulic automobile collision simulator. As shown in this drawing, the hydraulic automobile collision simulator is equipped with the cart 2 which carries the specimen 9 which consists of a dummy doll or the White body, and glides over a rail 1 top, the servo-actuator equipment 3 which hammers out this cart 2 in a target acceleration wave, operation and the control panel 4 which are installed near this servo-actuator equipment 3, and the hydraulic power unit 5 which supplies hydraulic oil to servo-actuator equipment 3.

[0015] The hydraulic power unit 5 consists of a pump unit, a tank unit, a cooling system, etc., and supplies the hydraulic oil accumulated to the accumulator (after-mentioned) of a servo actuator 3. The cart return mechanism 6 for leading the hammered-out cart 2 to an initial valve position near the servo-actuator equipment 3 is installed. The shock absorber 7 is installed in the end of a rail 1 as a safety device for overrun of a cart 2. Operation is performed by operation and the control panel 4. Servo-actuator equipment 3 hammers out the cart 2 which carries the specimen 9 which consists of a dummy doll or the White body in a target acceleration wave. Thereby, a cart 2 glides over a rail 1 top, and stops by the internal-organs brake.

[0016] The example of said servo-actuator equipment 3 is shown in drawing 2. As shown in this drawing, the outline configuration of the servo-actuator equipment 3 is carried out by the actuator 10, the accumulator 12, and the servo valve 11. An actuator 10 consists of the piston 14 and piston rod 15 which were formed in a cylinder 13 and this cylinder 13. A piston rod 15 is projected to piston 14 order both sides, anterior part is projected outside from the anterior part of a cylinder 13, a tip counters the back end side of said cart 2, a projection is established outside from the posterior part of a cylinder 13, and, as for the posterior part, covering 16 is formed in the perimeter.

[0017] An accumulator 12 becomes the back end section of the cylinder 13 of an actuator 10 from a cylinder 13, the body 22 of an accumulator of the cylinder mold attached in parallel, and the piston 23 prepared in this

body 22 of an accumulator. \*\* of the anterior part (actuator 10 side) of this piston 23 is filled up with hydraulic oil 24, and hind \*\* is filled up with gas 25, such as nitrogen. \*\* of the body 22 of an accumulator and a cylinder 13 are linked directly in passage 26. A pressure oil is supplied to passage 26 through piping 28 from the pump unit of a hydraulic power unit 5.

[0018] A servo valve 11 consists of spool 21 prepared at the anterior part periphery of the cylinder 13 of an actuator 10 in a cylinder 13, the valve body 18 of the cylinder mold attached in parallel, and this valve body 18. The port 19 which passes in an actuator 10, and the port 20 which passes to an oil tank are formed in the valve body 18. It is made to operate with the control signal of a request of this spool 21, and the path of ports 19 and 20 is opened and closed.

[0019] Next, actuation of the above-mentioned servo-actuator equipment 3 is explained. Through piping 28, hydraulic oil 24 is supplied to an accumulator 12, and pressure is accumulated from the pump unit of a hydraulic power unit 5 to it. A piston 14 moves ahead by the pressure of the hydraulic oil 24 of an accumulator 12, a piston rod 15 is turned to a cart 2, and is hammered [ the hydraulic oil in an actuator 10 flows out of ports 19 and 20, ] out, and a cart 2 and a specimen 9 are made to generate acceleration equivalent to a real vehicle collision by moving the spool 21 of a servo valve 11 leftward [ of drawing 2 ] in this condition, and opening between a port 19 and 20.

[0020] As mentioned above, since it is considered as the so-called meter out control system which controls the hydraulic oil which flows a servo valve 11 out of an actuator 10 by this example, it is high pressure with the hydraulic oil equal to the pressure of an accumulator 12 at the time of printing initiation of a piston rod 15 in an actuator 10, therefore since the rigidity of hydraulic oil becomes high, printing responsibility improves. Generally, the simulation precision of the whole collision wave is greatly influenced by the precision immediately after printing, and can raise the whole simulation precision greatly by raising the responsibility at the time of printing.

[0021] If an actuator 10 is controlled by the meter out control system of this invention, at the time of printing initiation of the condition of drawing 2, the hydraulic oil in an actuator 10 is high pressure equally to the pressure of an accumulator 12, and since the rigidity of hydraulic oil becomes high, it will hammer out, and will enable it for responsibility to become good and to raise the responsibility at the time of printing.

[0022]

[Effect of the Invention] As mentioned above, since what is necessary is just to change arrangement of a servo valve while being able to raise the responsibility at the time of printing by adopting the meter out control system which controls the amount of the hydraulic oil which flows out of an actuator by the servo valve according to this invention and being able to raise greatly the simulation wave precision in an automobile collision simulator like a publication, it is effective in being realizable by low cost.

[0023] Moreover, since the accumulator and the actuator are directly linked through passage, while according to this invention the hydraulic oil of an accumulator carries out a direct action to the piston of an actuator and powerful and high printing of precision of it becomes possible, since the servo valve is attached in the anterior part periphery of a cylinder, it can constitute the meter out which is an outflow side and controls hydraulic oil. Moreover, since the piston rod formed before and after the piston has projected from cylinder order according to this invention, it becomes possible to make good actuation of balance perform at a piston.

## TECHNICAL FIELD

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[Field of the Invention] This invention relates to the servo-actuator equipment in the automobile collision simulator which used the meter out control system.

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## PRIOR ART

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[Description of the Prior Art] The servo-actuator equipment used for drawing 3 by the conventional automobile collision simulator is shown. The outline configuration of this servo-actuator equipment 3 is carried out with the actuator 10, the servo valve 11, and the accumulator 12. An actuator 10 consists of the piston 14 and piston rod 15 which were formed in a cylinder 13 and this cylinder 13. The piston rod 15 was projected from the anterior part of a cylinder 13, and the tip has countered the back end side of said cart 2. [0003] The servo valve 11 consists of spools 31 prepared in the oil sac 30 formed in the posterior part of the cylinder 13 of an actuator 10. The passage 32 containing hydraulic oil and the passage 33 which discharges hydraulic oil to an oil tank are connected [ oil sac / 30 ].

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[0005] The hydraulic oil 24 accumulated with the accumulator 12 flows into an actuator 10 through passage 36, a piston rod 15 is hammered out, and a cart 2 and a specimen 9 are made to generate acceleration equivalent to a real vehicle collision, when a servo valve 1 opens.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] As mentioned above, since what is necessary is just to change arrangement of a servo valve while being able to raise the responsibility at the time of printing by adopting the meter out control system which controls the amount of the hydraulic oil which flows out of an actuator by the servo valve according to this invention and being able to raise greatly the simulation wave precision in an automobile collision simulator like a publication, it is effective in being realizable by low cost.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Since the servo-actuator equipment in the above-mentioned conventional automobile collision simulator is a meter-in system which controls the amount of the hydraulic oil which flows into an actuator 10 by the servo valve 11, the oil pressure force in the actuator 10 before printing initiation is equal to atmospheric pressure. This meter-in system did not have the leakage of the hydraulic oil from a piston rod 15, and since it started printing in the condition that the rigidity of the hydraulic oil in an actuator is low while it had the advantage that the capacity of the pump at the time of pressure accumulation of an accumulator 12 was small, and ended, its initial responsibility of a piston was bad and it had the technical problem that simulation wave precision was bad.

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## MEANS

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[Means for Solving the Problem] This invention is characterized by connecting said accumulator so that it may be servo-actuator equipment in the automobile collision simulator which hammers out a specimen towards the cart to carry and hydraulic oil may flow the piston rod of an actuator into said actuator directly with the hydraulic oil accumulated with the accumulator, in order to solve this technical problem, connecting said servo valve so that the hydraulic oil which flows out of an actuator may be controlled, and constituting the meter-out circuit.

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[0021] If an actuator 10 is controlled by the meter out control system of this invention, at the time of printing initiation of the condition of drawing 2, the hydraulic oil in an actuator 10 is high pressure equally to the pressure of an accumulator 12, and since the rigidity of hydraulic oil becomes high, it will hammer out, and will enable it for responsibility to become good and to raise the responsibility at the time of printing.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram of the automobile collision simulator using servo-actuator equipment.

[Drawing 2] It is the vertical section side elevation showing the example of the servo-actuator equipment in the automobile collision simulator of this invention.

[Drawing 3] It is the vertical section side elevation of conventional servo-actuator equipment.

[Description of Notations]

2 Cart

3 Servo-Actuator Equipment

5 Hydraulic Power Unit (Pump Unit)

10 Actuator

11 Servo Valve

12 Accumulator

13 Cylinder

14 Piston

15 Piston Rod

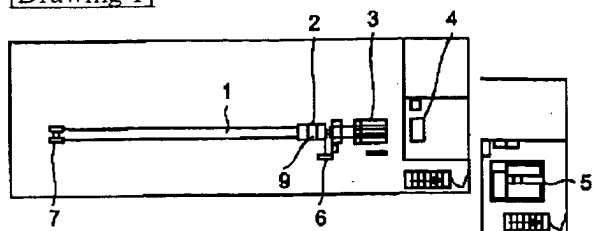
24 Hydraulic Oil

26, 32, 33 Passage

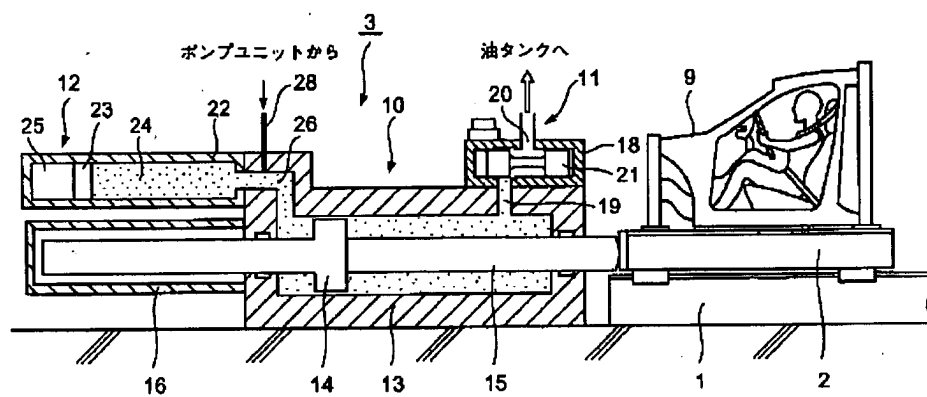
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# DRAWINGS

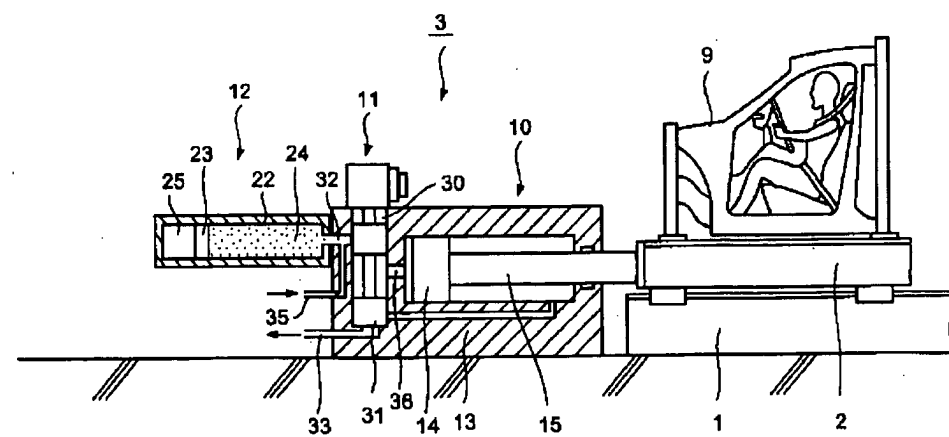
[Drawing 1]



[Drawing 2]



[Drawing 3]



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H 3 H 0 8 9

F 1 5 B 11/02

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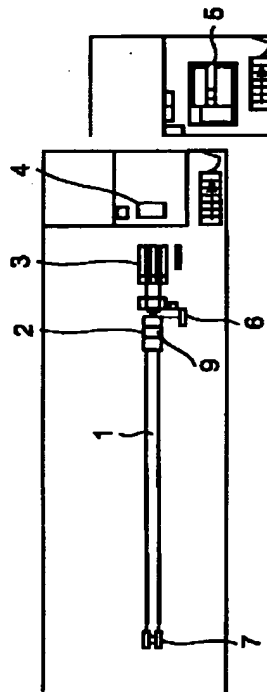
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(54) 【発明の名称】 自動車衝突シミュレータにおけるサーボアクチュエータ装置

(57) 【要約】

【課題】 油圧アクチュエータ10から流出する作動油の量を制御するメータアウト方式を採用することにより、シミュレーション波形精度を向上させた自動車衝突シミュレータにおけるサーボアクチュエータ装置を提供する。

【解決手段】 アキュムレータ12に蓄積・蓄圧された作動油14で油圧アクチュエータ10のピストンロッド15を供試体9を搭載するカート2に向けて打ち出す自動車衝突シミュレータにおけるサーボアクチュエータ装置であって、前記油圧アクチュエータ10に作動油が直接流入するように前記アキュムレータ12が接続され、油圧アクチュエータ10から流出する作動油を制御するように前記サーボ弁11が接続されてメータアウト回路を構成している。



## 【特許請求の範囲】

【請求項1】 アキュムレータで蓄圧された作動油により油圧アクチュエータのピストンロッドを供試体を搭載するカートに向けて打ち出す自動車衝突シミュレータにおけるサーボアクチュエータ装置であって、

前記油圧アクチュエータに作動油が直接流入するように前記アキュムレータが接続され、油圧アクチュエータから流出する作動油を制御するように前記サーボ弁が接続されてメータアウト回路を構成していることを特徴とする自動車衝突シミュレータにおけるサーボアクチュエータ装置。

【請求項2】 前記アキュムレータは、前記油圧アクチュエータのシリンダの後部に該シリンダと平行に取付けられ、前記アキュムレータと前記シリンダとが流路を介して直結され、該流路にポンプユニットから前記アキュムレータに作動油を供給する管路が連結され、前記サーボ弁は前記シリンダの前部外周に該シリンダと平行に取付けられ、該サーボ弁と前記シリンダとが流路を介して接続されていることを特徴とする請求項1記載の自動車衝突シミュレータにおけるサーボアクチュエータ装置。

【請求項3】 前記ピストンロッドは、ピストンの前後に設けられて前記シリンダの前後から外部に突出していることを特徴とする請求項1又は2記載の自動車衝突シミュレータにおけるサーボアクチュエータ装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、メータアウト制御方式を用いた自動車衝突シミュレータにおけるサーボアクチュエータ装置に関する。

【0002】

【従来の技術】図3に、従来の自動車衝突シミュレータに使用されるサーボアクチュエータ装置を示している。このサーボアクチュエータ装置3は、油圧アクチュエータ10と、サーボ弁11と、アキュムレータ12とで概略構成されている。油圧アクチュエータ10は、シリンダ13と、このシリンダ13内に設けられたピストン14およびピストンロッド15からなる。ピストンロッド15はシリンダ13の前部から突出して先端が前記カート2の後端面に対向している。

【0003】サーボ弁11は、油圧アクチュエータ10のシリンダ13の後部に形成された油室30に設けられたスプール31で構成されている。油室30には作動油が入る流路32と、作動油を油タンクに排出する流路33が接続されている。

【0004】アキュムレータ12は、シリンダ13の後端部に取付けられたシリンダ型のアキュムレータ本体22と、このアキュムレータ本体22内に設けられたピストン23とからなる。ピストン23の前部（油圧アクチュエータ10側）の室には作動油24、後部の室には窒素等のガス25が充填されている。作動油24は前記流

路32からサーボ弁11に流れ、流路32にはポンプユニットから圧油を供給する配管35が通じている。

【0005】サーボ弁11が開くことにより、アキュムレータ12で蓄圧された作動油24が流路36を介して油圧アクチュエータ10に流入し、ピストンロッド15を打ち出し、カート2および供試体9に実車衝突と同等の加速度を発生させるものである。

【0006】

【発明が解決しようとする課題】上記した従来の自動車衝突シミュレータにおけるサーボアクチュエータ装置は、油圧アクチュエータ10に流入する作動油の量をサーボ弁11で制御するメータイン方式であるため、打ち出し開始前の油圧アクチュエータ10内の油圧力は大気圧と等しくなっている。このメータイン方式は、ピストンロッド15からの作動油の漏れがなく、アキュムレータ12の蓄圧時のポンプの容量が小さくてすむという利点がある反面、アクチュエータ内の作動油の剛性が低い状態で打ち出しを開始することから、ピストンの初期応答性が悪く、シミュレーション波形精度が悪いという課題があった。

【0007】本発明は、かかる従来技術の課題に鑑み、油圧アクチュエータから流出する作動油の量を制御するメータアウト制御方式を採用することにより、シミュレーション波形精度を向上させた自動車衝突シミュレータにおけるサーボアクチュエータ装置を提供することを目的とする。

【0008】

【課題を解決するための手段】本発明は、かかる課題を解決するために、アキュムレータで蓄圧された作動油により油圧アクチュエータのピストンロッドを供試体を搭載するカートに向けて打ち出す自動車衝突シミュレータにおけるサーボアクチュエータ装置であって、前記油圧アクチュエータに作動油が直接流入するように前記アキュムレータが接続され、油圧アクチュエータから流出する作動油を制御するように前記サーボ弁が接続されてメータアウト回路を構成していることを特徴とする。

【0009】かかる発明によれば、サーボ弁を閉じた状態でアキュムレータに作動油を供給して蓄圧しておき、この状態でサーボ弁を開くことにより、油圧アクチュエータ内の作動油が流出し、アキュムレータの作動油の圧力でピストンロッドを打ち出してカートに当てて実車衝突と同等の加速度をカートおよび供試体に発生させる。このように、サーボ弁を流出側の作動油を制御するメータアウト制御方式としたので、ピストンロッドの打ち出し開始時には油圧アクチュエータ内の作動油はアキュムレータの圧力と等しい高圧となり、作動油の剛性が高くなるので、打ち出し応答性が向上し、シミュレーションの全体精度を大きく向上させることができる。

【0010】また、本発明は、前記アキュムレータは、前記油圧アクチュエータのシリンダの後部に該シリンダ

と平行に取付けられ、前記アキュムレータと前記シリンダとが流路を介して直結され、該流路にポンプユニットから前記アキュムレータに作動油を供給する管路が連結され、前記サーボ弁は前記シリンダの前部外周に該シリンダと平行に取付けられ、該サーボ弁と前記シリンダとが流路を介して接続されていることを特徴とする。

【0011】かかる発明によれば、アキュムレータと油圧アクチュエータとが流路を介して直結しているため、アキュムレータの作動油が油圧アクチュエータのピストンに直接作用し、強力かつ精度の高い打ち出しが可能となると共に、サーボ弁はシリンダの前部外周に取付けられているため、作動油を流出側で制御するメータアウトを構成することができる。

【0012】また、本発明は、前記ピストンロッドは、ピストンの前後に設けられて前記シリンダの前後から外部に突出していることを特徴とする。かかる発明によれば、ピストンの前後に設けられたピストンロッドがシリンダの前後から突出しているため、ピストンにバランスのよい動作を行わせることが可能となる。

【0013】

【発明の実施の形態】以下、本発明を図面に示した実施例を用いて詳細に説明する。但し、この実施例に記載される構成部品の寸法、形状、その相対配置などは特に特定の記載がない限り、この発明の範囲をそのみに限定する趣旨ではなく、単なる説明例にすぎない。なお、各図において、図3と同一部材または同一機能のものは同一符号で示している。

【0014】図1は、油圧式自動車衝突シミュレータの概略構成図である。同図に示すように、油圧式自動車衝突シミュレータは、ダミー人形やホワイトボディからなる供試体9を搭載してレール1上を滑走するカート2と、このカート2を目標加速度波形にて打ち出すサーボアクチュエータ装置3と、このサーボアクチュエータ装置3の近傍に設置されている運転・制御盤4と、サーボアクチュエータ装置3に作動油を供給する油圧源5とを備えている。

【0015】油圧源5は、ポンプユニット、タンクユニット、冷却装置等で構成されており、サーボアクチュエータ3のアキュムレータ（後述）に蓄圧する作動油を供給するものである。サーボアクチュエータ装置3の近傍には、打ち出されたカート2を初期位置まで牽引するためのカート復帰装置6が設置されている。レール1の末端部にはカート2のオーバーラン用安全装置としてショックアブソーバ7が設置されている。運転操作は運転・制御盤4により行われる。サーボアクチュエータ装置3は、ダミー人形やホワイトボディからなる供試体9を搭載するカート2を目標加速度波形にて打ち出すものである。これにより、カート2はレール1上を滑走し、内臓ブレーキにより停止するようになっている。

【0016】図2に、前記サーボアクチュエータ装置3

の実施例を示している。同図に示すように、サーボアクチュエータ装置3は、油圧アクチュエータ10と、アキュムレータ12と、サーボ弁11とで概略構成されている。油圧アクチュエータ10は、シリンダ13と、このシリンダ13内に設けられたピストン14およびピストンロッド15からなる。ピストンロッド15はピストン14の前後両面に突出され、前部はシリンダ13の前部から外部に突出して先端が前記カート2の後端面に対向し、後部はシリンダ13の後部から外部に突出し、その周囲にカバー16が設けられている。

【0017】アキュムレータ12は、油圧アクチュエータ10のシリンダ13の後端部にシリンダ13と平行に取付けられたシリンダ型のアキュムレータ本体22と、このアキュムレータ本体22内に設けられたピストン23とからなる。このピストン23の前部（油圧アクチュエータ10側）の室には作動油24が、後部の室には窒素等のガス25が充填されている。アキュムレータ本体22とシリンダ13の各々の室は流路26で直結されている。流路26には油圧源5のポンプユニットから配管28を介して圧油を供給するようになっている。

【0018】サーボ弁11は、油圧アクチュエータ10のシリンダ13の前部外周にシリンダ13と平行に取付けられたシリンダ型の弁本体18と、この弁本体18内に設けられたスプール21からなる。弁本体18には油圧アクチュエータ10内に通ずるポート19と油タンクに通ずるポート20が形成されている。このスプール21を所望の制御信号で動作させてポート19、20の通路を開閉するようになっている。

【0019】次に、上記サーボアクチュエータ装置3の動作を説明する。油圧源5のポンプユニットから配管28を介してアキュムレータ12に作動油24を供給して蓄圧する。この状態でサーボ弁11のスプール21を図2の左方向に移動させてポート19、20間を開くことにより、油圧アクチュエータ10内の作動油がポート19、20から流出し、アキュムレータ12の作動油24の圧力でピストン14が前方に移動してピストンロッド15をカート2に向けて打ち出し、実車衝突と同等の加速度をカート2および供試体9に発生させる。

【0020】以上のように、本実施例では、サーボ弁11を油圧アクチュエータ10から流出する作動油を制御する、いわゆるメータアウト制御方式としたので、ピストンロッド15の打ち出し開始時には油圧アクチュエータ10内の作動油はアキュムレータ12の圧力と等しい高圧であり、したがって、作動油の剛性が高くなるので、打ち出し応答性が向上する。一般に衝突波形全体のシミュレーション精度は、打ち出し直後の精度に大きく影響され、打ち出し時の応答性を上げることで、シミュレーションの全体精度を大きく向上させることができる。

【0021】本発明のメータアウト制御方式にて油圧ア



クチュエータ10を制御すると、図2の状態の打ち出し開始時には、油圧アクチュエータ10内の作動油はアキュムレータ12の圧力と等しく高压であり、作動油の剛性が高くなるので打ち出し応答性が良くなり、打ち出し時の応答性を上げることが可能になる。

【0022】

【発明の効果】以上、記載のごとく、本発明によれば、油圧アクチュエータから流出する作動油の量をサーボ弁で制御するメータアウト制御方式を採用することにより、打ち出し時の応答性を上げることができ、自動車衝突シミュレータにおけるシミュレーション波形精度を大きく向上させることができると共に、サーボ弁の配置を変更するだけでよいので、低コストで実現できるという効果がある。

【0023】また、本発明によれば、アキュムレータと油圧アクチュエータとが流路を介して直結しているため、アキュムレータの作動油が油圧アクチュエータのピストンに直接作用し、強力かつ精度の高い打ち出しが可能となると共に、サーボ弁はシリンダの前部外周に取付けられているため、作動油を流出側で制御するメータアウトを構成することができる。また、本発明によれば、ピストンの前後に設けられたピストンロッドがシリンダの前後から突出しているため、ピストンにバランスのよ

い動作を行わせることが可能となる。

【図面の簡単な説明】

【図1】 サーボアクチュエータ装置を用いた自動車衝突シミュレータの概略構成図である。

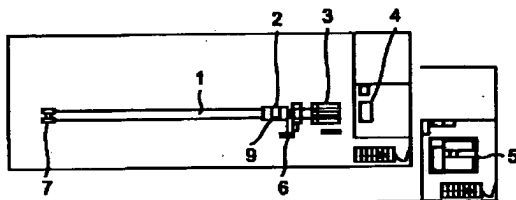
【図2】 本発明の自動車衝突シミュレータにおけるサーボアクチュエータ装置の実施例を示す縦断側面図である。

【図3】 従来のサーボアクチュエータ装置の縦断側面図である。

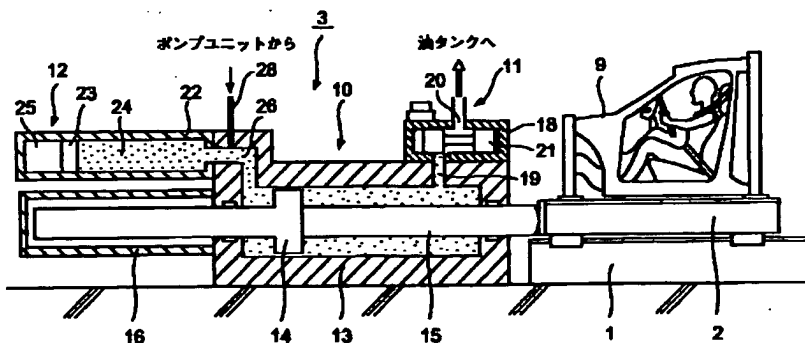
【符号の説明】

2	カート
3	サーボアクチュエータ装置
5	油圧源（ポンプユニット）
10	油圧アクチュエータ
11	サーボ弁
12	アキュムレータ
13	シリンダ
14	ピストン
15	ピストンロッド
20	作動油
26、32、33	流路
28	管路

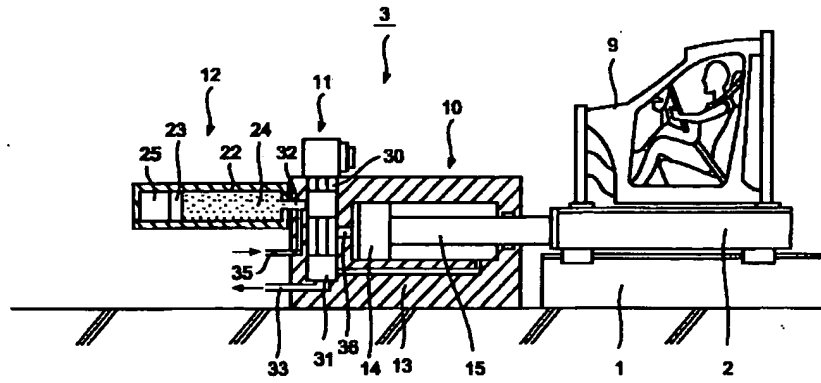
【図1】



【図2】



【図3】



フロントページの続き

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